NASA Ames Research Center
Intelligent Systems Division, http://ti.arc.nasa.gov/
Technical News and Activities: May 22, 2008

Robust Software Engineering
Robust Software Engineering Group

C GLOBAL SURVEYOR USED FOR ISS WATER RECOVERY SYSTEM VERIFICATION

HIGHLIGHT: Guillaume Brat participated in the verification of the software controlling the Water Recovery System (WRS) for the International Space Station (ISS). WRS is composed of two systems, the Water Processor Assembly (WPA) and the Urine Processor Assembly (UPA). Both systems are controlled by software developed in the C language at Marshall Space Flight Center (MSFC).

Having done some static analysis on an early version of the UPA a few years ago, Brat was asked by Robert Erickson (MSFC) to analyze the latest version of the UPA code using C Global Surveyor, a static analyzer for C programs developed by Guillaume Brat and Arnaud Venet in the Robust Software Engineering group in the Intelligent Systems Division (Code TI) at NASA Ames. Brat's analysis was able to certify that the UPA code is free of pointer manipulation problems, although the code does not seem portable to other platforms; however, as portability was not a stated requirement, no code modification was deemed necessary.

Under the leadership of Michael Flynn (ARC-SCB, Space Biosciences Division), Brat also participated in the certification of the verification packages done by Robert Erickson (MSFC) on the UPA and WPA software. The work consisted in verifying that the verification done by MSFC and its contractors actually guarantees an acceptable level of correctness for human-rated software. The verification had been done by MSFC partly through manual analysis (i.e., determining if the code meets the requirements, and if there are any gaps in the requirements) and through testing. As a verification and validation (V&V) expert reviewing verification packages, Brat reviewed early packages and suggested additional tests. The analysis of the final packages demonstrated an acceptable level of verification.

BACKGROUND: Currently, astronauts aboard the International Space Station (ISS) receive their water from Russian delivery missions and from a device that catches some moisture from respiration and recycles it into limited amounts of drinking water. This water replenishment is a costly endeavor, and it is not sustainable as the number of astronauts on board the ISS increases. Marshall Space Flight Center has been working with contractors on a system, called the Water Recovery System, that will provide up to 28 gallons of potable recycled water per day and will help the station accommodate up to six crew members.. The WRS will reclaim waste water from the Space Shuttle's fuel cells, from urine, from oral hygiene and hand washing, and by condensing humidity from the air. The WRS departed May 12 from MSFC to Kennedy Space Center for final flight preparations. The Water Recovery System is scheduled to fly aboard Space Shuttle Endeavour on STS-126 later this year.

TEAM MEMBERS: Michael Flynn (ARC-SCB), Robert Erickson (MSFC)

FUNDING PROGRAM: ECLSS (Environmental Control and Life Support System) program at JSC.

POC: Guillaume Brat, guillaume.p.brat@nasa.gov